

What is claimed is:

- 1 1. A light emitting device, comprising:
2 a light emitting element; and
3 an adhesion layer to bond the light emitting element to
4 a mounting member;
5 wherein the adhesion layer is composed of inorganic
6 material particles and a transparent inorganic binding layer
7 to be formed between the neighboring inorganic material
8 particles, and the inorganic material particles are
9 substantially connected with each other in the adhesion layer.
- 1 2. The light emitting device according to claim 1,
2 wherein:
3 the inorganic material particles are of diamond.
- 1 3. The light emitting device according to claim 1,
2 wherein:
3 the inorganic material particles are covered with the
4 transparent inorganic binding layer, and the transparent
5 inorganic binding layer has a thickness of equal to or less than
6 an average diameter of the inorganic material particles.
- 1 4. The light emitting device according to claim 1,
2 wherein:
3 the light emitting element is of flip-chip type, and a
4 space between an electrode face of the light emitting element
5 and the mounting member is filled with the adhesion layer.

1 5. The light emitting device according to claim 1,
2 wherein:

3 the transparent inorganic binding layer is formed by
4 heating inorganic-coating forming liquid that includes a
5 mixture of the hydrolysate and the hydrolysis/condensation
6 polymer of an alkoxide compound represented by general formula:
7 $M^{a+}(OR^1)_mR^2_{a-m}$, where M includes any one of Si, Al, Zr and Ti,
8 R^1 is hydrocarbon group with a carbon number of 1 to 5,
9 alkoxyalkyl group or acyl group, R^2 is an organic group
10 including at least one selected from vinyl, amino, imino, epoxy,
11 acryloyloxy, methacryloyloxy, phenyl, mercapto and alkyl
12 groups, a is a valance of M, and a and m are integers.

1 6. An adhesion layer for bonding a light emitting element
2 to a member, comprising:

3 diamond particles; and

4 transparent inorganic binding layer;

5 wherein the diamond particles are substantially
6 connected each other in the adhesion layer.

1 7. A method of forming an adhesion layer for bonding a
2 light emitting element to a mounting member, comprising the
3 steps of:

4 preparing adhesion layer precursor material by mixing
5 inorganic-coating forming liquid and inorganic material
6 particles; and

7 thermally treating the adhesion layer precursor material
8 while laying the adhesion layer precursor material between the
9 light emitting element and the mounting member.

1 8. The method according to claim 7, wherein:
2 the thermally treating step is conducted at a temperature
3 of 500 °C or lower.

1 9. The method according to claim 7, wherein:
2 the inorganic-coating forming liquid includes a mixture
3 of the hydrolysate and the hydrolysis/condensation polymer of
4 an alkoxide compound represented by general formula:
5 $M^a(OR^1)_mR^2_{a-m}$, where M includes any one of Si, Al, Zr and Ti,
6 R^1 is hydrocarbon group with a carbon number of 1 to 5,
7 alkoxyalkyl group or acyl group, R^2 is an organic group
8 including at least one selected from vinyl, amino, imino, epoxy,
9 acryloyloxy, methacryloyloxy, phenyl, mercapto and alkyl
10 groups, a is a valance of M, and a and m are integers.

1 10. A light emitting device, comprising:
2 a light emitting element; and
3 an adhesion layer to bond the light emitting element to
4 a mounting member;
5 wherein the adhesion layer is formed by thermally
6 treating adhesion layer precursor material that
7 inorganic-coating forming liquid and diamond particles are
8 mixed.

1 11. The light emitting device according to claim 1,
2 wherein:
3 the inorganic material particles are of phosphor.

1 12. The light emitting device according to claim 11,
2 wherein:

3 the phosphor particles are covered with the transparent
4 inorganic binding layer, and the transparent inorganic binding
5 layer has a thickness of equal to or less than an average diameter
6 of the phosphor particles.

1 13. The light emitting device according to claim 11,
2 wherein:

3 the light emitting element is of flip-chip type, and a
4 space between an electrode face of the light emitting element
5 and the mounting member is filled with the adhesion layer.

1 14. The light emitting device according to claim 11,
2 wherein:

3 the transparent inorganic binding layer is formed by
4 heating inorganic-coating forming liquid that includes a
5 mixture of the hydrolysate and the hydrolysis/condensation
6 polymer of an alkoxide compound represented by general formula:
7 $M^{a+}(OR^1)_mR^2_{a-m}$, where M includes any one of Si, Al, Zr and Ti,
8 R^1 is hydrocarbon group with a carbon number of 1 to 5,
9 alkoxyalkyl group or acyl group, R^2 is an organic group
10 including at least one selected from vinyl, amino, imino, epoxy,
11 acryloyloxy, methacryloyloxy, phenyl, mercapto and alkyl
12 groups, a is a valance of M, and a and m are integers.

1 15. The method according to claim 7, wherein:

2 the inorganic material particles are of phosphor.

1 16. A method of making a light emitting device, comprising
2 the steps of:
3 preparing precursor material by mixing inorganic-coating
4 forming liquid and phosphor particles;
5 molding a phosphor frame that opens in the optical axis
6 of light emitting element using the precursor material; and
7 fixing the light emitting element in the phosphor frame.

1 17. A light emitting device, comprising:
2 a phosphor frame that opens in the optical axis of light
3 emitting element; and
4 the light emitting element that is fixed in the phosphor
5 frame;
6 wherein the phosphor frame is composed of phosphor
7 particles and transparent inorganic binding layer, and the
8 phosphor particles are substantially connected each other in
9 the phosphor frame.

1 18. A light emitting device, comprising:
2 a light emitting element; and
3 a phosphor layer that radiates fluorescent light while
4 being excited by light emitted from the light emitting element;
5 wherein the phosphor layer is composed of phosphor
6 particles and transparent inorganic binding layer to be formed
7 between the neighboring phosphor particles.

1 19. The light emitting device according to claim 18,
2 wherein:
3 the phosphor particles are covered with the transparent

4 inorganic binding layer, and the transparent inorganic binding
5 layer has a thickness of equal to or less than an average diameter
6 of the phosphor particles.

1 20. The light emitting device according to claim 18,
2 wherein:

3 the transparent inorganic binding layer is formed by
4 heating inorganic-coating forming liquid that includes a
5 mixture of the hydrolysate and the hydrolysis/condensation
6 polymer of an alkoxide compound represented by general formula:
7 $M^{a+}(OR^1)_mR^2_{a-m}$, where M includes any one of Si, Al, Zr and Ti,
8 R^1 is hydrocarbon group with a carbon number of 1 to 5,
9 alkoxyalkyl group or acyl group, R^2 is an organic group
10 including at least one selected from vinyl, amino, imino, epoxy,
11 acryloyloxy, methacryloyloxy, phenyl, mercapto and alkyl
12 groups, a is a valance of M, and a and m are integers.

1 21. A light emitting device, comprising:

2 a light emitting element; and

3 a phosphor layer that radiates fluorescent light while
4 being excited by light emitted from the light emitting element;

5 wherein the phosphor layer is composed of phosphor
6 particles and transparent inorganic binding layer to be formed
7 between the neighboring phosphor particles, and the phosphor
8 particles are filled to be substantially connected with each
9 other in the phosphor layer.

1 22. A phosphor layer for light emitting element,
2 comprising:

3 phosphor particles; and
4 transparent inorganic binding layer to be formed between
5 the neighboring phosphor particles;
6 wherein the phosphor particles are filled to be
7 substantially connected with each other in the phosphor layer.

1 23. A phosphor layer for light emitting element,
2 comprising:

3 phosphor particles; and
4 transparent inorganic binding layer to be formed between
5 the neighboring phosphor particles;
6 wherein a space is formed between the phosphor particles.

1 24. A method of forming a phosphor layer for light emitting
2 device, comprising the steps of:

3 preparing phosphor layer precursor material by mixing
4 inorganic-coating forming liquid and phosphor particles; and
5 thermally treating the phosphor layer precursor
6 material.

1 25. The method according to claim 24, wherein:
2 the thermally treating step is conducted at a temperature
3 of 500 °C or lower.

1 26. The method according to claim 24, wherein:
2 the inorganic-coating forming liquid includes a mixture
3 of the hydrolysate and the hydrolysis/condensation polymer of
4 an alkoxide compound represented by general formula:
5 $M^{a-}(OR^1)_mR^2_{a-m}$, where M includes any one of Si, Al, Zr and Ti,

6 R^1 is hydrocarbon group with a carbon number of 1 to 5.
7 alkoxyalkyl group or acyl group. R^2 is an organic group
8 including at least one selected from vinyl, amino, imino, epoxy,
9 acryloyloxy, methacryloyloxy, phenyl, mercapto and alkyl
10 groups, a is a valance of M, and a and m are integers.

1 27. The method according to claim 24, wherein:
2 the phosphor layer precursor material is coated on a light
3 emitting element.

1 28. The method according to claim 24, wherein:
2 the phosphor layer is molded using the phosphor layer
3 precursor material.

1 29. A method of making a light emitting device, comprising
2 the steps defined in the method of forming the phosphor layer
3 according to claim 24.

1 30. A light emitting device, comprising:
2 a light emitting element; and
3 a phosphor layer that radiates fluorescent light while
4 being excited by light emitted from the light emitting element;
5 wherein the phosphor layer is formed by thermally
6 treating phosphor layer precursor material that
7 inorganic-coating forming liquid and phosphor particles are
8 mixed.

1 31. A light emitting device, comprising:
2 a light emitting element; and

3 a molded phosphor layer that is of inorganic material
4 molded.

1 32. The light emitting device according to claim 31,
2 wherein:

3 the phosphor layer is formed around the light emitting
4 element.

1 33. The light emitting device according to claim 32,
2 wherein:

3 the phosphor layer has a lower end that is located lower
4 than a light emitting layer of the light emitting element.

1 34. The light emitting device according to claim 31,
2 further comprising:

3 transparent inorganic material that is filled between the
4 light emitting element and the phosphor layer.

1 35. The light emitting device according to claim 34,
2 wherein:

3 the phosphor layer is molded using phosphor layer
4 precursor material that inorganic-coating forming liquid and
5 phosphor particles are mixed, and the transparent inorganic
6 material is formed by hardening the inorganic-coating forming
7 liquid.

1 36. The light emitting device according to claim 35,
2 wherein:

3 th inorganic-coating forming liquid includes a mixture

4 of the hydrolysate and the hydrolysis/condensation polymer of
5 an alkoxide compound represented by general formula:
6 $M^{a+}(OR^1)_mR^2_{a-m}$, where M includes any one of Si, Al, Zr and Ti,
7 R^1 is hydrocarbon group with a carbon number of 1 to 5,
8 alkoxyalkyl group or acyl group, R^2 is an organic group
9 including at least one selected from vinyl, amino, imino, epoxy,
10 acryloyloxy, methacryloyloxy, phenyl, mercapto and alkyl
11 groups, a is a valance of M, and a and m are integers.